Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V EXAMINATION – WINTER 2025

Subject Code:3151106 Date:19-11-2025

Subject Name:Power Electronics

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Design VI characteristic of SCR. Show and explain the difference between holding current and latching current.	**03**
	(b)	Make the comparison between SCR and TRIAC.	**04**
	(c)	A single phase half wave controlled rectifier is operated from a 240 V, 50 Hz. Load resistance R = 20 Ω. If the average output voltage is 25% of the maximum possible average output voltage, determine: (1) the firing angle (2) rms and average output and SCR currents.	**07**
Q.2	**(a)**	Explain the effect of freewheeling diodes in power electronics circuits.	**03**
	(b)	Explain the SCR resistance-capacitance triggering circuit.	**04**
	(c)	Explain the operation of single phase semi controlled bridge converter with resistive and inductive load. Draw the associated waveforms.	**07**
		OR	
	(c)	A dc chopper circuit connected to 100 V dc source supplies an inductive load having 50 mH in series with resistance of 5 Ω. Freewheeling diodes is placed across the load. The load current varies between the limits of 10-12 A. Determine the time ratio of the chopper.	**07**
Q.3	**(a)**	What is the function of Chopper? Explain the working of step-up chopper.	**03**
	(b)	With help of waveform explain the current limit control strategy of chopper.	**04**
	(c)	With help of neat circuit diagram and waveforms, explain the operation of PWM half bridge inverter with resistive load.	**07**
		OR	
Q.3	**(a)**	What are the applications of chopper? Explain the working of class D chopper.	**03**
	(b)	Compare the step up and step down chopper.	**04**
	(c)	With help of neat circuit diagram and waveforms, explain the operation of single phase current source inverter.	**07**
Q.4	**(a)**	What is commutation? Explain self commutation.	**03**
	(b)	Explain the snubber circuits for thyristor.	**04**
	(c)	Explain the basic structure and VI characteristic of IGBT.	**07**
		OR	
Q.4	**(a)**	What is the function of an inverter? List out various applications of an inverter.	**03**
	(b)	Explain two transistor analogy of SCR.	**04**
	(c)	Draw and explain the structure of power MOSFET. Explain principle and operation and V-I characteristics of power MOSFET.	**07**

Q.5	**(a)**	Compare Power supply and SMPS.	**03**
	(b)	Explain the working of Fly back SMPS.	**04**
	(c)	Write short note on UPS.	**07**
		OR	
Q.5	**(a)**	Compare EMI and EMC.	**03**
	(b)	Explain the working of DC chopper drive.	**04**
	(c)	Write short note on P M Stepper Motor drives.	**07**

Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2024

Subject Code:3151106 Date:28-11-2024

Subject Name:Power Electronics

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define the following terms in connection with SCR: (1) Peak Inverse Voltage (2) Latching Current (3) Holding Current	**03**
	(b)	Describe dynamic Turn-ON switching characteristics of SCR.	**04**
	(c)	With the help of circuit diagram and relevant waveforms, explain the operation of continuous mode Flyback Converter. Also derive expression for voltage transfer ratio in terms of transformer turns ratio and duty cycle.	**07**
Q.2	**(a)**	The latching current of a thyristor circuit is 50mA. The duration of the firing pulse is 50µs. Will the thyristor get fired? Here R= 50 Ω, L= 0.5 H and V= 100V.	**03**
	(b)	Explain resistance firing circuit for SCR gate triggered.	**04**
	(c)	Discuss design consideration of Class- C commutation circuit with circuit diagram, operation and waveform.	**07**
		OR	
	(c)	For Class-D commutation circuit, compute the value of the commutation capacitor C and commutation inductor L for the following data: Edc= 50V, I_L (max)= 50A, t_{off} of SCR1= 30µs, chopping frequency f= 500 Hz and the load voltage variation required is 10 to 100%.	**07**
Q.3	**(a)**	Justify the statement: "Freewheeling diode improves the power factor of the system."	**03**
	(b)	Draw Circuit diagram and waveforms of single-phase half-controlled bridge rectifier for firing angle α = 90°.	**04**
	(c)	Discuss Rectifying mode and Inverting mode of fully controlled bridge rectifier circuit with Inductive load.	**07**
		OR	
Q.3	**(a)**	Explain Semiconverter. Draw two Semiconverter circuits.	**03**
	(b)	The DC-DC converter has a resistive load of R= 10 Ω and the input voltage is Vs=220V. When the converter switch remains on, its voltage drop is Vch= 2V and the chopping frequency is f= 1 KHz. If the duty cycle is 50%, determine (a) the average output voltage Va, (b) the rms output voltage Vo, (c) the converter efficiency.	**04**
	(c)	The single-phase half-bridged inverter has a resistive load of R= 2.4 Ω and the dc input voltage is Vs= 48V. Determine (a) the rms output voltage at the fundamental frequency Vo1, (b) the output power Po, (c) the average	**07**

and peak currents of each transistors, (d) the peak reverse blocking voltage V_{BR} of each transistor, (e) the THD, (f) the DF and (g) the HF and DF of the LOH.

Q.4	**(a)**	List applications of DC-DC converter.	**03**
	(b)	Justify this statement for step-up operation: "The conditions for controllable power transfer are $0 < Vs < E$."	**04**
	(c)	Explain step-down converter with RL load in details.	**07**

OR

Q.4	**(a)**	Give comparison between Voltage source Inverter and Current source Inverter.	**03**
	(b)	Discuss following performance parameter of Inverters: (1) Harmonic Factor of n^{th} harmonics (2) Total harmonic distortion (3) Distortion Factor (4) Lowest order Harmonics	**04**
	(c)	Explain single phase full bridge Inverter in details.	**07**
Q.5	**(a)**	Discuss the selection criteria for switching transistor of flyback converter.	**03**
	(b)	List speed control methods of Induction motor. Explain closed-loop speed control.	**04**
	(c)	With the help of neat circuit diagram and associated waveform, explain the operation of Zero voltage switching resonant converters in half-wave mode.	**07**

OR

Q.5	**(a)**	List application of various Power conditioners.	**03**
	(b)	Discuss Power line disturbances.	**04**
	(c)	Describe the operation of on-line UPS system with the help of neat block diagram. Also list the important specifications of on-line UPS.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2023

Subject Code:3151106 Date:07-12-2023

Subject Name:Power Electronics

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
   Simple and non-programmable scientific calculators are allowed.

Q.1	**(a)**	Describe V-I characteristics of TRIAC briefly.	**03**
	(b)	Explain in brief about IGBT.	**04**
	(c)	Discuss firing or triggering of Thyristor in detail.	**07**
Q.2	**(a)**	Write the usage of snubber circuit in power electronics.	**03**
	(b)	What is the usage of freewheeling diode in controlled rectifiers?	**04**
	(c)	Draw and explain the circuit of ac phase control using DIAC and TRIAC.	**07**
		OR	
	(c)	Draw necessary waveforms and explain working of single phase full controlled bridge rectifier circuit with RLE load.	**07**
Q.3	**(a)**	Explain Step down Chopper briefly.	**03**
	(b)	Compare class B and class C Chopper	**04**
	(c)	Explain the principal of Dielectric Heating. Also gives application of Dielectric Heating.	**07**
		OR	
Q.3	**(a)**	What is commutation circuit for Thyristor?	**03**
	(b)	Explain displacement factor and harmonic factor of rectifiers.	**04**
	(c)	Explain in brief the different control strategies for chopper.	**07**
Q.4	**(a)**	Draw the block diagram of UPS.	**03**
	(b)	Enlist advantages and disadvantages of multiphase chopper?	**04**
	(c)	Draw and explain the V-I characteristics of UJT.	**07**
		OR	
Q.4	**(a)**	Design and explain the operation of current source inverter.	**03**
	(b)	List different driver circuits for MOSFET and IGBT and explain one IC based driver circuit.	**04**
	(c)	Explain bridge square wave inverter with necessary diagrams.	**07**
Q.5	**(a)**	Compare online and offline UPS.	**03**
	(b)	What are the applications of an inverter?	**04**
	(c)	Explain Speed control of Motor.	**07**
		OR	
Q.5	**(a)**	Enlist advantages of DC chopper drive.	**03**
	(b)	What is soft switching? Enlist the types of soft switching.	**04**
	(c)	Explain the construction and working of flyback converter type switched mode DC power supply.	**07**

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2022

Subject Code:3151106 Date:06-01-2023

Subject Name:Power Electronics

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed**

			MARKS
Q.1	**(a)**	Draw and Explain V-I characteristics of DIAC briefly.	**03**
	(b)	List and Describe Turn ON methods for SCR.	**04**
	(c)	Discuss regenerative latching action in thyristor using two transistor analogy also derive equation for anode current.	**07**
Q.2	**(a)**	Define SCR commutation. Explain the self commutation in brief.	**03**
	(b)	Make the comparison between Power MOSFET and IGBT.	**04**
	(c)	Explain the operation of single phase fully controlled bridge converter with resistive and inductive load with associated waveforms.	**07**
		OR	
	(c)	Derive input supply power factor, displacement factor and harmonic factor for single phase full wave-controlled rectifier using its input current Fourier series analysis.	**07**
Q.3	**(a)**	Explain UJT as a relaxation oscillator.	**03**
	(b)	Draw the circuit diagram and explain the operation of step down chopper with the help of waveforms.	**04**
	(c)	Explain the different control strategies for chopper.	**07**
		OR	
Q.3	**(a)**	Explain Step up Chopper briefly.	**03**
	(b)	Differentiate between constant frequency and variable frequency operation of chopper.	**04**
	(c)	A step up chopper has input voltage of 220V and output voltage of 660V. If the nonconducting time of thyristor chopper is 100 μsec, compute the pulse width of output voltage. In case pulse width is halved for constant frequency operation, find the new output voltage.	**07**
Q.4	**(a)**	Design and explain the operation of current source inverter.	**03**
	(b)	Explain block diagram of SMPS.	**04**
	(c)	With help of neat circuit diagram and waveforms, explain the operation of PWM inverter with resistive load.	**07**
		OR	
Q.4	**(a)**	Compare voltage and current source inverter.	**03**
	(b)	Enlist the applications of Inverter.	**04**
	(c)	With the help of circuit diagram and waveforms, explain the working of single phase full bridge inverter.	**07**
Q.5	**(a)**	Compare online and offline UPS.	**03**
	(b)	Explain speed control of AC motor.	**04**

	(c)	Draw and explain the structure of power MOSFET. Also explain principle of operation and V-I characteristics of power MOSFET.	**07**

OR

Q.5	**(a)**	Enlist advantages of AC drives.	**03**
	(b)	Discuss EMI protection in brief.	**04**
	(c)	Explain the construction and working of flyback converter type switched mode DC power supply.	**07**

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